Scheme of Instruction and Syllabi

of

BE III and IV SEMESTERS

of

FOUR YEAR DEGREE COURSE

in

ELECTRONICS AND COMMUNICATION ENGINEERING

(AICTE Model Curriculum with effect from AY 2020-21)

R-20 Regulation

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

(Autonomous Institution under UGC, Affiliated to Osmania University)
Department of Electronics & Communication Engineering
Accredited by NBA and NAAC-UGC,
Chaitanya Bharathi (Post), Gandipet, Hyderabad–500075

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

OUR MOTTO: SWAYAM TEJASWIN BHAVA

Institute Vision	To be a centre of excellence in technical education and research.	
Institute Mission	To address the emerging needs through quality technical education and advanced research.	
Department Vision	To emerge as a vibrant model of excellence in education, research and innovation in Electronics and Communication Engineering.	
Department Mission	M1	To impart strong theoretical and practical knowledge of the state of art technologies to meet growing challenges in the industry
	M2	To carry out the advanced and need based research in consultation with the renowned research and industrial organizations
	M3	To create entrepreneurship environment including innovation, incubation and encourage to patent the work
PEO 1		Engage successfully in professional career and/or pursue higher education in Electronics and Communication and allied areas.
PEO 2		Pursue research, design and development of state-of-the art systems applying the knowledge of Electronics and Communication engineering
PEO 3		Begin start-ups and involve in entrepreneurship activities by adopting changing professional and societal needs.
PEO 4		Exhibit professional ethics and values with lifelong learning and work effectively as individuals/team members in multidisciplinary projects.
PSO 1		Ability to apply the acquired knowledge of core subjects in design and development of Communications/Signal processing/ VLSI/ Embedded systems.
PSO 2		Analyze and solve the complex Electronics and Communication engineering problems using state-of-art hardware and software tools
PSO 3		Develop innovative technologies for Entrepreneurship based on the research outcomes of Electronics and Communication engineering.

Program Outcomes of B.E (ECE) Program

1. Engineering Knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems
2. Problem Analysis	Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/Development of Solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.
4. Conduct Investigations of Complex Problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern Tool Usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling to complex engineering activities, with an understanding of the limitations.
6. The Engineer and Society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and Sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and Teamwork	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication	Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Project Management and Finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-long Learning	Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

AICTE Model Curriculum with effect from AY 2021-22

B.E (Electronics and Communication Engineering)

SEMESTER – III

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours Per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	20MTC07	Applied Mathematics	3	1	-	3	40	60	4
2	20CSC06	Basics of Data Structures	2	-	-	3	40	60	2
3	20ECC01	Electromagnetic Theory and Transmission Lines	3	-	-	3	40	60	3
4	20ECC02	Electronic Devices	3	-	-	3	40	60	3
5	20ECC03	Network Theory	3	-	-	3	40	60	3
6	20ECC04	Signals and Systems	3	-	-	3	40	60	3
7	20CEM01	Environmental Science	2	-	-	2	-	50	Non-Credit
PRACTICALS									
8	20CSC07	Basics of Data Structures Lab	-	-	2	3	50	50	1
9	20ECC05	Electronic Devices Lab	-	-	2	3	50	50	1
10	20ECC06	Electronic Workshop and Networks Lab	-	-	2	3	50	50	1
11	20ECI01	MOOCs/Training/Internship	3-4 Weeks/90 Hours				40	60	2
Total			**19**	**01**	**06**	**29**	**430**	**620**	**21+2**
Clock Hours Per Week: 26									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**

T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE: Semester End Examination**

20MTC07

APPLIED MATHEMATICS
(For ECE/EEE Programs)

Instruction	3 L+1T Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	4

Prerequisite: Students should have prior knowledge about circuit theory, coordinate systems and vector calculus.

Course Objectives:
This course aims to:
1. To learn the Laplace, Inverse Laplace Transform and Z-Transforms.
2. To learn the Z-Transform& inverse Z-Transform concepts
3. To form PDE and solve Linear and Non-Linear equations.
4. To find roots of equations, and Numerical solutions of Differential Equations.
5. To learn fitting of distribution and predicting the future values

Course Outcomes:
Upon completion of this course, students will be able to:
1. Find Laplace, Inverse Laplace and solution of engineering problems.
2. Find the solution of Difference Equation.
3. Understand the methods to find solution of linear and non-linear PDE and solution of wave equation.
4. Solve Non-Linear algebraic and transcendental equations and first order differential equations.
5. Understand the methods for analyzing the random fluctuations using probability distribution and also identify the importance of Principles of Least Squares approximations for predictions.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/ PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	-	-	-	-	-	2	1	-	1	1	-	-
CO 2	3	2	2	-	-	-	-	-	2	-	-	1	1	-	-
CO 3	3	2	2	-	-	-	-	-	2	-	-	1	1	-	-
CO 4	3	2	2	1	1	-	-	-	2	1	-	1	1	-	-
CO 5	3	2	2	1	1	-	-	-	2	1	-	1	1	-	-

UNIT-I
Laplace Transforms: Laplace Transform of Elementary functions, Linearity property, First Shifting property, Change of scale property. Laplace Transform of Periodic functions, Transforms of derivatives, Transforms of integrals, Multiplication by and division by Evaluation of Integrals by Laplace Transforms. Inverse Laplace transforms of elementary functions, Inverse Laplace Transform by Method of partial fractions and Convolution theorem, Solutions of Ordinary Differential Equations by Laplace Transform method. Laplace transform of Unit step and Unit Impulse function.

UNIT-II
Z-Transforms: Z-transforms of standard functions, linearity property, damping rule, shifting theorems, multiplication by 'n', Initial and Final value theorems. Inverse Z-transforms of standard functions, Inverse Z-transform by Convolution theorem and partial fractions method. Z-transform application to difference equations.

UNIT-III

Partial Differential Equations: Formation of Partial Differential Equations, Linear Equations of First Order (Lagrange's Linear Equations), Solution of First Order Non-linear Partial Differential Equation (Standard forms) and Charpits Method. Solutions by method of separation of variables, solution of one-dimensional wave equation and its applications.

UNIT-IV

Numerical Methods: Solution of Algebraic and transcendental equations by Bisection method, Regula-Falsi method Newton-Raphson method. Numerical Solutions of First Order Ordinary differential equations by Taylor's series method, Euler's method, Modified Euler's method and Runge-Kutta method of fourth order.

UNIT-V

Probability Distributions: Basic probability, Conditional probability, Bayes theorem. Random variable, discrete probability distribution and Continuous probability distribution. Expectation, properties of expectation, properties of variance. Poisson distribution, MGF and Cumulates of the Poisson distribution, Normal distribution, characteristics of Normal distribution MGF and CGF of Normal distribution, Areas under normal curve.

Text Books:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, 2017.
2. S.C. Gupta, V.K. Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, 2014.

Suggested Reading:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.
2. Veerarajan T, "Engineering Mathematics", Tata McGraw-Hill, New Delhi, 2008.
3. S.S. Sastry, "Introductory methods of numerical analysis", PHI, 4th Edition, 2005

20CSC06

BASICS OF DATA STRUCTURES

(Common for all Programs except CSE & IT)

Instruction	2 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	2

Prerequisite: Basic knowledge of programming language such as C or C++ is preferred (but not mandatory) and some mathematical maturity also will be expected.

Course Objectives:
This course aims to:

1. Basic linear and non-linear data structures.
2. Analyzing the performance of operations on data structures.
3. Different sorting and searching techniques and their complexities.

Course Outcomes:
Upon completion of this course, students will be able to:

1. Identify various data structures, searching & sorting techniques and their applications.
2. Describe the linear and non-linear data structures, searching and sorting techniques.
3. Apply suitable data structures to solve problems.
4. Analyze various searching and sorting techniques.
5. Evaluate the linear and non-linear data structures.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	2	2	1	3	3	1	-	-	-	-	2	3	3	2
CO 2	2	2	2	2	3	3	1	-	-	-	-	2	3	3	2
CO 3	2	2	2	1	3	2	1	-	-	-	-	2	3	3	2
CO 4	2	3	2	1	3	3	1	-	-	-	-	2	3	3	2
CO 5	2	2	2	1	3	2	1	-	-	-	-	2	3	3	2

UNIT-I
Introduction: Data Types, Data structures, Types of Data Structures, Operations, ADTs, Algorithms, Comparison of Algorithms- Complexity- Time and space tradeoff.
Recursion: Introduction, format of recursive functions, recursion Vs. Iteration, examples.

UNIT-II
Linked Lists: Introduction, Linked lists and types, Representation of linked list, operations on linked list, Comparison of Linked Lists with Arrays and Dynamic Arrays.

UNIT-III
Stacks and Queues: Introduction to stacks, applications of stacks, implementation and comparison of stack implementations. Introduction to queues, applications of queues and implementations, Priority Queues and applications

Searching and Sorting: Linear searching, binary Searching, sorting algorithms- bubble sort, selection sort, quick sort, heap sort.

UNIT-IV
Trees: Definitions and Concepts, Operations on Binary Trees, Representation of binary tree, Conversion of General Trees to Binary Trees, Representations of Trees, Tree Traversals, Binary search Tree.

UNIT-V
Graphs: Introduction, Applications of graphs, Graph representations, graph traversals, Minimal Spanning Trees.

Text Books:

1. Narasimha Karumanchi "Data Structures and Algorithms Made Easy", Career Monk Publications, 2017
2. E.Horowitz ,S. Sahni and Susan Anderson-Freed, "Fundamentals of Data structures in C", Silicon Press; 2nd Edition August 2007
3. Reema Thareja, "Data Structures using C", Oxford, 2014

Suggested Reading:

1. https://www.tutorialspoint.com/data_structures_algorithms/index.htm
2. https://www.edx.org/course/foundations-of-data-structures
3. https://sites.google.com/site/merasemester/data-structures/data-structures-1#DS
4. https://www.cs.usfca.edu/~galles/visualization/Algorithms
5. https://www.coursera.org/specializations/data-structures-algorithms

20ECC01

ELECTROMAGNETIC THEORYAND TRANSMISSION LINES

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Students should have prior knowledge about circuit theory, coordinate systems and vector calculus.

Course Objectives:
This course aims to:
1. The mathematical fundamentals necessary for understanding the electromagnetic theory.
2. The electrostatics and magnetics along with Maxwell's equations for EM Waves.
3. The concepts of transmission lines

Course Outcomes:
Upon completion of this course, students will be able to:
1. Comprehend mathematically the coordinate systems and solve simple static Electromagnetic problems using various laws and theorems.
2. Understand Maxwell's equations in different forms (differential and integral) and apply them to diverse engineering problems.
3. Demonstrate the Electromagnetic wave properties with respect to different transmission mediums.
4. Predict the behavior of reflection and refraction of the waves in different mediums.
5. Estimate the transmission line properties, reflection, and matching concepts.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/ PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	1	1	2	2	1	1	3	3	2	2	3	2	1
CO 2	3	3	3	3	2	3	3	3	3	3	2	2	3	2	1
CO 3	3	3	3	3	2	3	3	1	2	3	2	2	3	2	1
CO 4	3	3	3	3	2	3	3	1	2	3	2	2	3	2	1
CO 5	3	3	3	3	2	3	3	2	2	2	2	2	3	2	1

UNIT-I
Electrostatics: Review of coordinate systems, Coulomb's Law, Electric field, Electric flux, Flux density and Gauss Law. Potential and Potential gradient. Laplace's and Poisson's equations. Current, Current Density and Continuity of current equation.

UNIT-II
Steady Magnetics and Time varying Fields: Biot-Savart's law, Ampere's law, Magnetic flux and Magnetic flux density. Gauss law for magnetic fields, Vector magnetic potential. Boundary conditions. Time varying fields, Maxwell equations: Integral form and Point form.

UNIT-III

Electromagnetic Waves: Wave equations, Uniform plane waves in lossy and lossless medium. Skin Depth, Polarization, Instantaneous and average Poynting theorem and its applications. Reflection and Refraction of Plane Waves - Normal and Oblique Incidence for perfect Conductor and perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection.

UNIT-IV

Transmission Lines - I: Types, Parameters, Transmission Line Equations, Primary and Secondary Constants, Characteristics Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line. Impedance at any point on the transmission line.

UNIT-V

Transmission Lines - II: RF and UHF Lines, Open and Short circuit lines and their significance. Properties of λ/2, λ/4 and λ/8 Lines. Distortion and distortion less transmission line, Concept of loading of a transmission line, Campbell's formula. Reflection and VSWR. Matching: Quarter wave transformer, Single Stub matching. Smith chart and its applications.

Text Books:

1. Matthew N.O. Sadiku, "Elements of Electromagnetics", 7th Edition, New York Oxford University Press, 2018.
2. William H. Hayt Jr. and John A. Buck, "Engineering Electromagnetics", 8th Edition, TMH, 2016.
3. E.C. Jordan and K.G. Balmain, "Electromagnetic Waves and Radiating Systems", 2nd Edition, PHI, 2000.

Suggested Reading:

1. John D. Ryder, "Networks Lines and Fields", 2nd Edition, PHI, 2015.
2. R.K. Shevgaonkar, "Electromagnetics Waves", Tata McGraw Hill India, 2005.
3. Sunil Bhooshan, "Fundamentals of Engineering Electromagnetics", Oxford University Press Publication, 2012.

20ECC02

ELECTRONIC DEVICES

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Students should have the knowledge of semiconductor fundamentals.

Course Objectives:
This course aims to familiarize:
1. The concepts of semiconductor devices like PN junction diode, Transistor, and special diodes.
2. The applications of diodes.
3. The various configurations, characteristics of transistors – BJT, JFET & MOSFET.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Demonstrate understanding of the characteristic behaviour of various electronic devices such as Diodes, Transistors etc.
2. Apply the acquired knowledge in the analysis of various diode and Transistor circuits.
3. Compare and Contrast the characteristics of BJT and FET in various configurations.
4. Evaluate the performance parameters of various diode circuits (rectifiers, clippers and clampers) and Transistor circuits.
5. Choose an appropriate electronic device for a specific application and discuss IC fabrication process.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/ PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	2	-	1	1	-	-	2	-	-	-	2	3	3	1
CO 2	2	3	1	3	2	-	-	2	-	-	-	2	3	3	1
CO 3	-	2	-	1	-	-	-	2	-	-	-	2	3	3	1
CO 4	2	3	-	3	2	-	-	2	-	-	-	2	3	3	1
CO 5	-	3	-	2	2	-	-	2	-	-	-	2	3	3	1

UNIT – I
Semiconductor Diode Characteristics:
The p-n junction Diode, Energy band diagram, Current equations, I-V characteristics, Temperature dependence, Diode resistance, Transition capacitance, Diffusion capacitance, Zener diode - Regulator, Schottky diode.

UNIT – II
Diode Applications:
Diode as a circuit element, Clipping and Clamping circuits, Clamping circuit theorem. Half wave, Full wave and Bridge Rectifiers - their operation, performance characteristics- ripple factor calculations, and analysis; Filters (L, C, LC and CLC filters).

UNIT – III

Bipolar Junction Transistor:

Construction and Operation of NPN and PNP transistor, current components and current flow in BJT, Modes of transistor operation, Early effect, BJT input and output characteristics of CB, CE, CC configuration, h-parameters, determination of h-parameters from transistor characteristics.

UNIT – IV

Field Effect Transistor: Junction Field Effect Transistor: Principle of Operation - the Pinch-off Voltage V_P, V-I Characteristics of JFET.

MOSFETs: Enhancement & Depletion mode MOSFETs, V-I characteristics, CMOS inverter.

UNIT – V

Special Purpose Semi-Conductor Devices: Elementary treatment of SCR- UJT- Diac- Triac - Tunnel diode. LED, Photodiode, Solar cell. Introduction to Integrated circuit fabrication process: Oxidation, Diffusion, Ion implantation, Photolithography, Etching, Metallization.

Text Books:

1. Millman and Halkias, "Electronic Devices and Circuits", 2nd Edition, McGraw Hill Publication, 2007.
2. Robert L. Boylestad, "Electronic Devices and Circuit Theory", 10th Edition, PHI, 2009.
3. S.K. Gandhi, "VLSI Fabrication Principles: Silicon and Gallium Arsenide", Wiley India Pvt. Ltd., New Delhi, 2nd Edition. 1994.

Suggested Reading:

1. Jacob Millman, Christos Halkias, Chetan Parikh, "Integrated Electronics", 2nd Edition, McGraw Hill Publication, 2009.
2. David Bell, "Fundamentals of Electronic Devices and Circuits", 5th Edition, Oxford University Press, 2008.
3. Christian Piguet, "Low Power CMOS Circuits Technology, Logic Design and CAD Tools" 1st Indian Reprint, CRC Press, 2010.

20ECC03

NETWORK THEORY

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Knowledge on Elements of Electrical Engineering.

Course Objectives:
This course aims to:
1. Make understand the concepts of Electric Circuits, Network Theorems and the transients.
2. Make understand the concept of steady state and applying phasor analysis to AC circuits and analyzing magnetic coupled circuits.
3. Familiarize resonant circuits, two port network parameters, concept of Passive Filters and Network Synthesis.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Recall basics of electrical circuits with nodal and mesh analysis.
2. Illustrate electrical theorems for AC and DC Circuits.
3. Develop time domain and frequency domain analysis for circuits.
4. Analyze the electrical network and two port network parameters for different applications i.e., magnetic coupled circuits, Filters.
5. Synthesize different network functions using Foster and Cauer form.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	-	-	3	1	2	1	3	3	3	1	2	3
CO 2	2	2	3	1	-	1	-	1	1	1	2	2	2	2	1
CO 3	3	2	1	-	1	-	1	1	-	-	-	1	1	1	-
CO 4	2	2	1	2	-	1	2	-	1	1	1	1	1	1	1
CO 5	2	1	2	1	1	1	1	1	1	-	1	1	3	2	1

UNIT-I
Network Theorems: Network reduction techniques, Super Nodal and Super Mesh Analysis, Superposition, Thevenin's and Norton's theorems. Reciprocity, Maximum Power Transfer, Compensation, Millman's, Duality and Tellegen's Theorems using dependent and independent sources.

UNIT-II
Transients: Introduction, Study of initial conditions, DC transients RL, RC circuits, RLC circuits, Formulation of integral, differential equations. Circuit analysis using Laplace Transform and inverse Laplace Transform, Pole-Zero Plots, Zero Input Response, Zero State Response.

UNIT-III
Steady State Analysis of AC Circuits: Phasor and vector representations, impedance and admittance, Average power, Apparent Power, Complex Power, Power triangle.

Coupled circuits: Concept of self, mutual inductance, co-efficient of coupling, dot convention rules and analysis of simple circuits.

UNIT-IV

Frequency Domain Analysis: Concept of complex frequency, impedance and admittance functions, Series and parallel resonance, Q-factor, selectivity, bandwidth.

Two Port Networks: Z, Y, h, g, ABCD and Inverse ABCD parameters, equivalence of two port networks. Inter connection of two port networks.

UNIT-V

Filters: Introduction to Filters and classification of Filters (Low pass, High pass, Band pass and Band stop) and their design aspects.

Network Synthesis: Elements of circuit synthesis, Foster and Cauer forms of LC, RC and RL networks.

Text Books:

1. William H.Hayt, Jr.,Jck E. Kemmerly and Steven M.Durbin, "Engineering Circuit Analysis", 8th Edition, McGraw Hill, 2013.
2. Van Valkenberg M.E, "Network Analysis", PHI, New Delhi, 3rd Edition 2002.

Suggested Reading:

1. C. L. Wadhwai, "Network Analysis and Synthesis", 4th Edition, New Age Publications, 2016.
2. Sudhakar. A. and Shyam Mohan, S. P., "Circuits and Network", Tata McGraw Hill, New Delhi, 1994.

20ECC04

SIGNALS AND SYSTEMS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Knowledge of Differential and Integral Calculus.

Course Objectives:
This course aims to:
1. Know Signals and systems representation/classification and also the time and frequency domain analysis of continuous time signals with Fourier series, Fourier transforms and Laplace transforms.
2. Understand Sampling, time and frequency domain analysis of discrete time signals with DTFT and Z-Transforms.
3. Understand concepts of convolution and correlation integrals.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Classify signals, systems and analyse the signals using Transform techniques.
2. Evaluate signal characteristics using time and frequency domain analysis.
3. Assess the system stability and causality using ROC and Pole-Zero Plot.
4. Describe the sampling process and analyse the DT Signal/systems using DTF and Z-Transform.
5. Apply the Convolution and correlation concept for analysis of Signal and systems**.**

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	1	-	1	-	-	-	-	2	-	2	2	1	1
CO 2	3	2	1	-	1	-	-	-	-	2	-	2	2	1	1
CO 3	3	2	1	-	1	-	-	-	-	2	-	2	2	1	1
CO 4	3	2	1	-	1	-	-	-	-	2	-	2	2	1	1
CO 5	3	2	1	-	1	-	-	-	-	2	-	2	2	1	1

UNIT-I
Continuous Time Signals: Introduction to signals, their representations and classification. Introduction to systems and their classifications, Orthogonality of signals, Complete set of mutually orthogonal signals and Harmonic signals.
Signal Representation: Trigonometric Fourier series, Exponential Fourier series, Existence and Convergence. Symmetry conditions, Amplitude and Phase spectra. Power Spectral Density.

UNIT-II
Fourier Transforms: The direct and inverse Fourier transforms, Existence, Frequency spectrum and properties of Fourier Transforms, Fourier Transform of singularity functions and periodic signals. Energy Spectral Density, characteristics of linear systems, Distortion less system, Phase delay and group delay.

UNIT-III

Signal Representation by Generalized Exponentials: The Bilateral and unilateral Laplace transforms. Region of convergence and its properties. Properties of Laplace transform, Inverse Laplace transform, Laplace transform of periodic signals.

LTI System: Impulse response, System transfer function, Stability and Causality.

UNIT-IV

Discrete Time Signals: Sampling of continuous time signals. DTS representation. Discrete Time Fourier Transform and properties.

Z–Transform: The Direct Z-Transform, Region of convergence and its properties. S–Plane and Z–Plane correspondence, Z–Transform properties. Inverse Z–Transform.

Discrete LTI system: impulse response and system transfer function. Stability and Causality.

UNIT-V

Convolution: Continuous convolution, Graphical interpretation and its properties. Discrete convolution and its properties.

Correlation: Continuous Cross correlation, Auto correlation and properties. Discrete Cross correlation, Auto correlation and properties.

Text Books:

1. B. P. Lathi, "Signals, Systems and Communications", BS Publications, 3rd Edition, 2008.
2. Simon Haykin, "Signals and Systems", Wiley India, 5th Edition, 2009.

Suggested Reading:

1. Alan V. Oppenheim, Alan S. Willsky, S. Hamid Nawad, "Signals and Systems", PHI 2nd Edition, 2015.
2. M. J. Robert, "Fundamentals of signals and systems", McGraw Hill, 2008.
3. A. Rajeswari, "Signals and Systems", Wiley India Pvt. Ltd, Publications 2021.

20CEM01

ENVIRONMENTAL SCIENCE

(Common to all Programs)

Instruction	2 L Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	0 Marks
Credits	No Credits

Prerequisite: Basic knowledge of Science.

Course Objectives:

This course aims to:

1. Identify environmental problems arising due to over utilization of natural resources and understand the importance of use of renewable energy sources.
2. Become aware about the importance of eco system and interlinking of food chain.
3. Identify the importance of biodiversity in maintaining ecological balance.
4. Learn about various attributes of pollution management and waste management practices.
5. Contribute for capacity building of nation for arresting and/or managing environmental disasters.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Identify the natural resources and realise the importance of water, food, forest, mineral, energy, land resources and effects of over utilisation.
2. Understand the concept of ecosystems and realise the importance of interlinking of food chains.
3. Contribute for the conservation of biodiversity.
4. Suggest suitable remedial measure for the problems of environmental pollution and contribute for the framing of legislation for protection of environment.
5. Follow the environmental ethics and contribute to the mitigation and management of environmental disasters.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	-	-	-	-	-	3	-	-	-	-	1	1	-	-
CO 2	1	-	-	-	-	-	2	1	-	-	-	1	1	-	-
CO 3	1	-	-	-	-	-	2	1	-	-	-	1	1	-	-
CO 4	1	-	-	-	-	1	2	1	-	-	-	1	1	-	-
CO 5	1	-	-	-	-	1	2	1	-	-	-	1	1	-	-

UNIT-I

Environmental Studies: Definition, Scope and importance, need for public awareness.

Natural resources: Use and over utilization of Natural Resources - Water resources, Food resources, Forest resources, Mineral resources, Energy resources, Land resources.

UNIT-II

Ecosystems: Concept of an ecosystem, structure and function of an ecosystem, role of producers, consumers and decomposers, energy flow in an ecosystem, food chains, food webs, ecological pyramids, Nutrient cycling, Bio-geo chemical cycles, Terrestrial and Aquatic ecosystems.

UNIT-III

Biodiversity: Genetic, species and ecosystem biodiversity, Bio-geographical classification of India, India as a Mega diversity nation. Values of biodiversity, hot-spots of biodiversity, threats to biodiversity, endangered and endemic species of India, methods of conservation of biodiversity.

UNIT-IV

Environmental Pollution: Cause, effects and control measures of air pollution, water pollution, marine pollution, soil pollution, noise pollution and Solid waste management, nuclear hazards

Environmental Legislations: Environment protection Act, Air, Water, Forest & Wild life Acts, issues involved in enforcement of environmental legislation, responsibilities of state and central pollution control boards.

UNIT-V

Social issues and the environment: Water conservation methods: Rain water harvesting and watershed management, Environmental ethics, Sustainable development and Climate change: Global warming, Ozone layer depletion, forest fires, and Contemporary issues.

Text Books:

1. Y. Anjaneyulu, “Introduction to Environmental Science”, B S Publications, 2004.
2. Suresh K. Dhameja, “Environmental Studies”, S. K. Kataria& Sons, 2009

Suggested Reading:

1. C. S. Rao,” Environmental Pollution Control Engineering”, Wiley, 1991.
2. S. S. Dara, “A Text Book of Environmental Chemistry & Pollution Control”, S. Chand Limited, 2006.

20CSC07

BASICS OF DATA STRUCTURES LAB

(Common for all Programs except CSE & IT)

Instruction	2 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Prerequisite: Any Programming Language.

Course Objectives:

This course aims to familiarize:

1. Design and construct simple programs by using the concepts of Data structures as abstract data type.
2. To have a broad idea about how efficiently pointers can be used in the implement of data structures.
3. To enhance programming skills while improving their practical knowledge in data structures.
4. To strengthen the practical ability to apply suitable data structure for real time applications.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Implement the abstract data type.
2. Demonstrate the operations on stacks, queues using arrays and linked lists.
3. Apply the suitable data structures including stacks, queues to solve problems.
4. Analyse various searching and sorting techniques.
5. Choose proper data structures, sorting and searching techniques to solve real world problems.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	1	-	1	2	2	0	-	-	-	-	1	3	3	2
CO 2	2	2	1	2	3	2	1	-	-	-	-	1	3	3	2
CO 3	2	2	2	2	3	2	1	-	-	-	-	1	3	3	2
CO 4	2	3	2	3	3	3	1	-	-	-	-	2	3	3	2
CO 5	2	2	2	3	3	3	1	-	-	-	-	2	3	3	2

List of Experiments:

1. Implementation of operations on arrays
2. Implementation of Stack.
3. Implementation of Queue.
4. Implementation of basic operations on Single Linked List.
5. Implementation of Searching techniques.
6. Implementation of Sorting Techniques
7. Case study like Banking System, Students Marks Management, Canteen Management, Library Management etc.,

Suggested Reading:

1. Brian W Kernighan, Dennis Ritchie, C Programming Language, PH PTR, 2nd Edition.
2. Richard M Reese, Understanding and Using C Pointers, O`Reily, 2013.

Weblinks:

1. https://nptel.ac.in/courses/106102064/
2. https://www.udemy.com/algorithms-and-data-structures-in-python/

20ECC05

ELECTRONIC DEVICES LAB

Instruction	2 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Prerequisite: Students have the knowledge of semiconductor fundamentals.

Course Objectives:
This course aims to familiarize:
1. The V-I characteristics of diodes and special semiconductor devices.
2. The design and performance evaluation of various diodes as rectifiers.
3. The characteristics of transistor in various configurations.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Demonstrate the characteristic behaviour of PN junction diode, Zener diode and special purpose semiconductor diodes.
2. Design various non-linear wave shaping circuits using diodes for a given specification.
3. Analyse the behaviour of non-linear wave shaping circuits using diodes.
4. Examine the characteristics of BJT and FET in various configurations.
5. Evaluate and compare the significant parameters obtained from the characteristics of BJT and FET.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	2	-	1	2	-	-	2	2	2	2	2	3	3	2
CO 2	2	2	-	1	2	-	-	2	2	2	2	2	3	3	2
CO 3	2	2	-	1	2	-	-	2	2	2	2	2	3	3	2
CO 4	2	2	-	1	2	-	-	2	2	2	2	2	3	3	2
CO 5	2	2	-	1	2	-	-	2	2	2	2	2	3	3	2

List of Experiments:

1. V-I Characteristics of Silicon and Germanium diodes and measurement of static and dynamic resistances.
2. Zener diode characteristics and its application as voltage regulator.
3. Clipping and Clamping Circuits.
4. Design, realization and performance evaluation of half wave rectifiers without filters and with filters (capacitor filter and π - section filter).
5. Design, realization and performance evaluation of full wave rectifiers without filters and with C & π section filters.
6. Plotting the characteristics of BJT in Common Base configuration and measurement of h-parameters.
7. Plotting the characteristics of BJT in Common Emitter configuration and measurement of h-parameters.
8. Plotting the characteristics of BJT in Common Collector configuration and measurement of h-parameters.

9. Plotting the characteristics of JFET in CS configurations and measurement of Transconductance and Drain resistance.
10. Characteristics of special semi-conductor devices-UJT and SCR.
11. Characteristics of LED and photo diode.
12. Characteristics of Tunnel diode.
13. **Structured Enquiry:** Design a switching circuit using BJT and JFET and analyse its operation.
14. **Open ended Enquiry:** Design a LED running lights circuit for vehicles to avoid accidents in fog/rain condition.

Note:

1. Wherever possible, Analysis and design of circuits shall be carried out using simulation tools.
2. A minimum of 12 experiments should be performed.

Suggested Reading:

1. Robert Diffenderfer, "Electronic Devices Systems and Applications", Cengage Learning India Private Limited, 2010.
2. Paul B. Zbar, Albert P. Malvino, Michael A. Miller, "Basic Electronics, A Text - Lab Manual", 7th Edition, TMH 2001.
3. Mahesh Jain, "Practical semiconductors data manual No.3", BPB Publications, 1981.
4. Bharath Electronics Ltd., "Semiconductors data manual", IEC Publication 134, 1969.

20ECC06

ELECTRONIC WORKSHOP AND NETWORKS LAB

Instruction	2 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Prerequisite: Knowledge of basic Electrical components, circuits and equipment.

Course Objectives:
This course aims to:
1. Understand the basic Concepts of Electric Circuits and equipment Like CRO, Multimeter and LCR–Q meter
2. Verify network theorems.
3. Analyze Resonant circuits, Attenuators and passive filters.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Identify and measure the passive and active components using electronic equipment.
2. Apply Network theorems to AC and DC Circuits.
3. Determine and analyze two port network parameters.
4. Design and verification of attenuator and filters.
5. Simulation of different networks and circuits using the simulation software.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	-	-	-	-	1	1	-	-	-	-	1	-	1	1
CO 2	3	3	3	2	2	2	1	1	1	2	1	2	1	3	2
CO 3	1	2	-	-	1	1	1	-	-	-	-	1	-	1	1
CO 4	2	2	1	1	-	1	1	1	1	1	1	-	1	1	1
CO 5	1	-	-	-	1	-	-	-	-	-	-	1	-	-	-

List of Experiments:

1. Study of RLC components, Bread board, Regulated power supply, Function generator, CRO Measurement of R, L, C components using color code, multimeter and LCR - Q Meter.
2. Practice of Soldering and de -soldering for simple circuits on single and Multi-Layer PCBs.
3. Verification of Superposition theorem and Tellegen's theorem.
4. Verification of Maximum power transfer theorem. Verification of Reciprocity theorem.
5. Verification of Compensation theorem and Millman's theorem. Verification of Transient Response in RC, RL Circuits.
6. Design and Verification of Series Resonance.
7. Determination of two-port network parameters (Z, Y, h, T).
8. Design and Verification of Constant-K low-pass filter.
9. To sense and measure ambient temperature by Pmod TMP3 sensor with My RIO kit.
10. **Structured Enquiry:** Design and Verification of Parallel Resonance.
11. **Open ended Enquiry:** Design and Verification of Constant-K high-pass filter.

Note: Experiments are to be simulated by using any simulation software.

Suggested Reading:

1. Thomas Petruzzellis, "Build Your Own Electronics Workshop", McGraw-Hill Companies, Inc., 2005.
2. A.M. Zungeru, J.M. Chuma, M. Mangwala, L.K. Ketshabetswe, "Handbook of Laboratory Experiments in Electronics and Communication Engineering", Vol. 2, 1st Edition, Notion press, 2017.

20ECI01

MOOCs/Training/Internship

Instruction/Demonstration/Training	3-4 Weeks/90 Hours
Duration of Semester End Presentation	--
Semester End Evaluation	60 Marks
Mid Term Evaluation	40 Marks
Credits	2

Prerequisite: Knowledge of basic Sciences and Engineering Sciences

Course Objectives:
This course aims to:
1.
2.
3.

Course Outcomes:
Upon completion of this course, students will be able to:
1.
2.
3.
4.
5.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1															
CO 2															
CO 3															
CO 4															
CO 5															

For further information refer Internship document

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

AICTE Model Curriculum with effect from AY 2021-22

B.E (Electronics and Communication Engineering)

SEMESTER – IV

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	20ECC07	Analog Circuits	3	-	-	3	40	60	3
2	20ECC08	Analog Communication	3	-	-	3	40	60	3
3	20ECC09	Antennas and Wave Propagation	3	-	-	3	40	60	3
4	20ECC10	Control Systems	3	-	-	3	40	60	3
5	20ECC11	Digital Systems Design	3	-	-	3	40	60	3
6	20EGM03	Universal Human Values II: Understanding Harmony	2	1	-	3	50	50	3
7	20EGM01	Indian Constitution and Fundamental Principles	2	-	-	2	-	50	Non-Credit
8	20EGM02	Indian Traditional Knowledge	2	-	-	2	-	50	Non-Credit
PRACTICALS									
9	20ECC12	Analog Circuits Lab	-	-	2	3	50	50	1
10	20ECC13	Analog Communication Lab	-	-	2	3	50	50	1
11	20ECC14	Digital Systems Design Lab	-	-	2	3	50	50	1
Total			**21**	**1**	**06**	**31**	**400**	**600**	**21**
Clock Hours Per Week: 28									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**

T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE: Semester End Examination**

20ECC07

ANALOG CIRCUITS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Student should have knowledge on Electronic Devices and Network Analysis.

Course Objectives:
This course aims to:
1. The Understand the applications of BJT & FET as a switch and an amplifier.
2. Analysis of BJT & FET in various configurations using small signal equivalent models and their frequency response.
3. Know concept of multistage, feedback amplifiers, and power amplifier and their analysis.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Recall and relate the knowledge of BJT and FET behavior in the design of various biasing and amplifier circuits.
2. Apply low and high frequency models of transistor in the analysis of single stage and multistage amplifiers.
3. Design and analyze amplifier and oscillator circuits.
4. Compare and Contrast different types of biasing, Multistage, Feedback and Power amplifiers.
5. Interpret a given analog circuit and evaluate its performance parameters by applying acquired knowledge.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	3	-	-	-	-	-	-	-	1	3	2	1
CO 2	3	3	3	2	-	-	-	-	-	-	-	1	3	2	1
CO 3	3	3	3	3	-	-	-	-	-	-	-	1	3	2	1
CO 4	3	3	3	2	-	-	-	-	-	-	-	1	3	2	1
CO 5	3	2	1	2	-	-	-	-	-	-	-	1	3	2	1

UNIT-I
Transistor Biasing: BJT biasing techniques, stability factors, Bias compensation techniques, Thermal runaway, Thermal stability, BJT as an amplifier and as a switch. JFET biasing-zero current drift biasing, biasing of JFET, FET as an amplifier and as a switch.

UNIT-II
Single Stage Amplifiers: Analysis of BJT circuits using h-parameters in CB, CE and CC configurations - their comparison (approximate and exact analysis), Millers Theorem & its duality – application circuits. Analysis of FET circuits using small-signal model for CS and CD configurations - their comparison. Frequency response of BJT and FET Amplifiers.

UNIT-III
Multistage amplifiers: Coupling schemes - RC coupling, Transformer coupling and Direct coupling; Analysis of CE-CE, CE-CB, CE-CC, CC-CC – Darlington pair.

Transistor at high frequencies: Hybrid π CE transistor model, Hybrid π Conductances and Capacitances, CE short circuit current gain, Current gain with resistive load.

UNIT-IV

Feed Back Amplifiers: The feedback concept, General characteristics of negative feedback amplifier, Effect of negative feedback on input and output impedances. Method of analysis of feedback amplifiers, Analysis of Voltage series, voltage shunt, current series and current shunt feedback amplifiers.

Oscillators: Positive feedback and conditions for sinusoidal oscillations, RC oscillator, LC oscillator, Crystal oscillator, Amplitude and frequency stability of oscillator.

UNIT-V

Large Signal Amplifies & Voltage Regulators: Large Signal Amplifiers: BJT as large signal audio amplifiers, Classes of operation, Harmonic distortion, Class A resistive coupled and transformer coupled amplifiers, Class-B Push-pull and complementary symmetry amplifiers, Class AB operation. power dissipation and efficiency calculations. Heat sinks.

Voltage Regulators: Transistor series and shunt voltage regulators.

Text Books:

1. Jacob Millman, Christos Halkias, Chetan Parikh, "Integrated Electronics – Analog and Digital Circuits and Systems", 2nd Edition, McGraw Hill Publication, 2010.
2. Robert L. Boylestad, "Electronic Devices and Circuit Theory", 10th Edition, PHI, 2009.

Suggested Reading:

1. David Bell, "Fundamentals of Electronic Devices and Circuits", 5th Edition, Oxford University Press, 2008.
2. Millman and Halkias, "Electronic Devices and Circuits" 2nd Edition, McGraw Hill Publication, 2007.
3. Donald Schilling, Charles Belove, Tuvia Apelewicz Raymond Saccardi, "Electronic Circuits: Discrete and Integrated", TMH, 3rd Edition, 2012.

20ECC08

ANALOG COMMUNICATION

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: A prior knowledge of signals and systems is required.

Course Objectives:
This course aims to:
1. Introduce the fundamentals of analog communication.
2. Provide the design details of various transmitters and receivers used in analog communication system.
3. Involve the students in analyzing performance of communication system by estimating noise.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Understand the various linear and nonlinear modulation schemes.
2. Design various transmitters and receivers.
3. Assess a random signal by computing various statistical properties.
4. Evaluate the performance of analog communication system through the estimation of noise.
5. Infer the concepts of various pulse modulation schemes.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	1	0	2	3	3	1	3	2	2	3	2	2
CO2	3	3	3	3	0	3	3	3	1	3	3	3	3	2	2
CO3	3	3	3	3	0	3	3	0	0	3	3	3	3	1	1
CO4	3	3	3	3	0	3	3	3	1	3	3	3	3	2	2
CO5	3	3	3	1	0	2	3	3	1	3	2	2	3	2	2

UNIT – I
Linear Modulation Schemes:
Need for Modulation, Double Side Band Suppressed Carrier Modulation, Balanced Modulator, Coherent Detector and Costas Detector. Conventional Amplitude Modulation, Phasor Diagram of AM, Switching Modulator, Envelope Detector. Hilbert Transform and its Properties. Single Side Band Modulation. Vestigial Side Band Modulation.

UNIT – II
Non-Linear Modulation Schemes:
Angle Modulation, Frequency Modulation and Phase modulation, Concept of Instantaneous Phase and Frequency. Types of FM modulation: Narrow Band FM and Wide Band FM. FM Spectrum in Terms of Bessel Functions. Phasor Diagram of NBFM. Direct and Indirect (Armstrong's) methods of FM Generation. Foster–Seeley Discriminator for FM Detection. Introduction to PLL.

UNIT – III

Transmitters and Receivers:

High Level and Low Level AM Transmitters. Principle and Operation of Tuned Radio Frequency receiver and Super Heterodyne Receivers. Selection of RF Amplifier. Choice of Intermediate Frequency. Image Frequency and its Rejection Ratio, Receiver Characteristics: Sensitivity, Selectivity, Fidelity. Double Spotting, Pre-emphasis and De-emphasis.

UNIT – IV

Random Variables and Random Process: Concept of random variable, Uniform Random Variable, Gaussian Random Variable. Random Process: Concept of random process, Stationarity and Ergodicity, Auto Correlation and its Properties, Power Spectral Density and its Properties. Linear System with Random inputs: Random Signal Response of Linear System, Auto Correlation of Response.

UNIT – V

Noise: Thermal Noise. White Noise. Noise Temperature. Noise in Two-Port Network: Noise Figure, Equivalent Noise Temperature and Noise Bandwidth. Noise Figure and Equivalent Noise Temperature for Cascaded Stages. Figure of Merit Calculations for AM, DSB-SC and SSB systems. Pulse Analog Modulation Schemes: PAM, PWM and PPM. Generation and detection of PAM, PWM and PPM.

Text Books:

1. Simon Haykin, "Communication Systems",2nd Edition, Wiley India,2011.
2. Herbert Taub, Donald L. Shilling & Goutam Saha, "Principles of Communication Systems", 3rd Edition, TMH, 2008.
3. Peyton Z. Peebles JR., "Probability Random Variables and Random Signal Principles", Tata McGraw Hill, 4th Edition, 2002.

Suggested Reading:

1. Singh, R.P. and Sapre, S.D., "Communication Systems", TMH, 2007.

20ECC09

ANTENNAS AND WAVE PROPAGATION

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Students should have prior knowledge about Electromagnetics theory and Maxwell's equations.

Course Objectives:
This course aims to:
1. The basic principles of an antenna and its parameters for characterizing its performance.
2. The fundamental concepts of various types of antennas, arrays for customizing the pattern parameters.
3. The propagation behavior of the radio wave in both troposphere and ionosphere.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Understand the basic parameters of an antenna.
2. Extend current distribution concept in order to estimate the field patterns.
3. Appraise the concepts of broad side and end fire arrays.
4. Understand the working principle and characteristics of various antennas.
5. Study the behavior of radio waves in various modes of wave propagation.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	1	2	1	1	1	1	1	1	2	2	3	2	1
CO 2	2	2	3	3	2	3	3	3	2	2	2	2	3	2	1
CO 3	2	2	2	2	2	2	2	2	1	1	1	2	3	2	1
CO 4	3	3	3	2	2	3	3	3	3	3	3	2	3	2	1
CO 5	2	3	1	2	2	2	2	2	2	1	2	2	3	2	1

UNIT-I
Antenna Basics: Principles of radiation, Retarded potential, Isotropic, Directional and Omni- directional radiators. Basic antenna parameters: Radiation patterns, radiation intensity, far field, near field, gain and directivity, Antenna Polarization, effective aperture area and efficiency. Point sources, current distribution, Friis transmission formula.

UNIT-II
Antenna Analysis: Analysis of Infinitesimal dipole, Half-wave dipole, quarter wave monopole, loop antenna and their far field patterns, calculation of radiation resistance and directivity.

UNIT-III
Antenna Arrays: Concept of Antenna Array. Uniform linear array: Broadside and End-fire arrays Calculation of Directivity and Beamwidth. Two element array of Infinitesimal dipoles. Qualitative treatment of nonlinear arrays: Binomial and Chebyshev arrays.

UNIT-IV

Practical Antennas: Qualitative treatment of Helical Antennas: Normal and Axial mode patterns, wideband characteristics. Characteristics, radiation principles and applications of Rhombic Antenna, Yagi-Uda antenna, Parabolic antenna system, Log-Periodic antenna. Microstrip antennas: Radiation mechanism, different types, advantages and disadvantages. Design of rectangular Microstrip antenna.

UNIT-V

Wave Propagation: Ground wave propagation, Space and Surface waves, Tropospheric refraction and reflection, Duct propagation. Sky wave propagation: Critical frequency, Maximum Usable Frequency (MUF) and Skip distance, Line of sight propagation.

Text Books:

1. Constantine A. Balanis, "Antenna Theory: Analysis and Design", 4th Edition, John Wiley, 2016.
2. Edward C. Jordan and Kenneth G. Balmain, "Electromagnetic Waves and Radiating Systems", 2nd Edition, PHI, 2001.

Suggested Reading:

1. John D. Krauss, Ronald J. Marhefka and Ahmad S. Khan, "Antennas and Wave Propagation", 4th Edition, TMH, 2010.
2. Dennis Roody and John Coolen, "Electronic Communications", 4th Edition, Prentice Hall, 2008.

20ECC10

CONTROL SYSTEMS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: The student is expected to have knowledge of Laplace transform and electrical and electronic circuits.

Course Objectives:
This course aims to:
1. Introduce various control systems (Open and closed loop) and their equivalent mathematical models using block diagrams, signal flow graphs and state space techniques.
2. Analyze the time and frequency response of control system to access the transient response and steady state response.
3. Study different types of stability concepts in control systems
4. Design various controllers and compensators to improve the system dynamic performance.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Distinguish the closed-loop control systems from open-loop control systems and develop mathematical models in time domain (differential equations, state equations) and S-domain (Transfer function using Laplace transform).
2. Evaluation of transfer function from block diagram and signal flow graph by using block diagram reduction techniques and Mason gain formula, respectively.
3. Investigate the stability of control system via Routh-Hurwitz criteria, Root-locus method and Nyquist Plot.
4. Utilize standard test signals to analyze the time response of first and second-order control systems and frequency response analysis of the control system.
5. Design and develop various controllers and compensators to control the steady state error, stability and transient response.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	1	1	-	1	1	-	-	-	-	1	3	2	2
CO 2	3	3	1	2	1	1	1	-	-	-	-	1	3	2	2
CO 3	3	3	3	3	2	1	1	-	-	-	-	1	3	2	2
CO 4	3	3	2	3	2	1	1	-	-	-	-	1	3	2	2
CO 5	3	3	3	2	1	1	1	-	-	-	-	1	3	2	2

UNIT-I
Control System Fundamentals: Classification of control systems, Open and Closed Loop control systems, Block diagram reduction and signal flow graphs, Mathematical modelling of a Mechanical system and conversion into Electrical system.

UNIT-II
Time Response Analysis: Transfer function and Impulse Response, Types of Inputs, Transient Response of first and second Order System with different inputs, Time domain Specifications. Types of Systems, static error coefficients, error series, PD, PI and PID controllers.

UNIT-III
Routh-Hurwitz criteria for stability. Root Locus Techniques, Analysis of typical systems using root locus techniques, Effect of location of roots on system response.

UNIT-IV
Frequency Response Analysis: Frequency domain specifications, bode plot, Principle of Argument, Nyquist plot and stability criterion, Gain and Phase Margins from the Bode and Nyquist diagrams. Lead and Lag compensators.

UNIT-V
State Space Analysis: Concept of State, State Variable, State vector and State space. State space representations of linear time invariant systems, State transition matrix, Solution of state equation, Controllability, Observability and Design of control systems using state variable feedback.

Text Books:

1. I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International Publishers, 5th Edition 2012.
2. Benjamin C. Kuo, "Automatic Control Systems", 7th Edition, PHI, 2010.

Suggested Reading:

1. K. Ogata, "Modern Control Engineering", EEE, 5th Edition, PHI, 2003.
2. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", 11th Edition Pearson, 2008.
3. Gopal Madan, "Digital control engineering" 1st Edition, New age publishers, 2008.

20ECC11

DIGITAL SYSTEM DESIGN

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Knowledge of Electronic device concepts.

Course Objectives:
This course aims to:
1. Learn various techniques for logic minimization.
2. Comprehend the concepts of various combinational circuits and sequential circuits.
3. Learn the Language fundamentals of Verilog HDL, also able to simulate and synthesize various digital modules.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Understand the basic concepts related to digital system design.
2. Design the combinational and sequential circuits.
3. Analyze the behavior of the digital system design.
4. Develop the digital system using various Verilog HDL modeling.
5. Apply the design concepts of digital system using Verilog HDL.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	1	1	3	2	1	1	-	-	-	-	-	3	2	2
CO 2	3	2	2	3	2	1	1	1	-	-	1	1	3	3	2
CO 3	3	3	3	3	2	1	1	1	1	-	1	2	3	2	2
CO 4	3	3	3	3	2	2	1	2	2	1	1	2	3	2	3
CO 5	3	3	3	3	2	2	1	2	2	1	1	2	3	2	2

UNIT-I
Logic Simplification and Combinational Logic Design: Number system representation and conversion, Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Introduction to Logic Gates, Ex-OR, Ex-NOR operations, Minimization of Switching Functions: Karnaugh map method, Quine –McCluskey Tabular Minimization Method. Logic function realization: AND-OR, OR-AND and NAND/NOR realizations.

UNIT-II
Introduction to Combinational Design: Binary Adders, Subtractors and BCD adder, Code converters Binary to Gray, Gray to Binary, BCD to excess3, BCD to Seven Segment display, Decoders, Encoders, Priority Encoders, Multiplexers, Demultiplexers, Comparators Implementations of Logic Functions using Decoders and Multiplexers.

UNIT-III
Sequential Logic Design: Latches, Flipflops, Difference between latch and flipflop, types of flipflops like S-R, D, T JK and Master-Slave JK FF, Edge triggered FF, flipflop conversions, setup and hold times, Ripple and Synchronous counters, Shift registers, Finite state machines, Design of synchronous FSM, Algorithmic State Machines charts.

UNIT-IV

Introduction to HDLs: VLSI Design flow, Basic Concepts of Verilog HDL, Data Types, System Tasks and Compiler Directives. Gate Level Modelling: Gate Types and Gate Delays. Dataflow Modeling: Continuous Assignment and Delays. Design of Stimulus Block.

UNIT-V

Behavioral Modeling: Structured Procedures, Procedural Assignments, Timing control, Conditional statements, Sequential and Parallel Blocks. Switch level Modelling. Introduction to tasks and functions. Design of Mealy and Moore state models using Verilog HDL. Introduction to Logic Synthesis. Concept of Programming using FPGA.

Text Books:

1. Morris Mano M. and Michael D.Ciletti, "Digital Design, With an Introduction to Verilog HDL", 5th Edition, Pearson 2013.
2. Samir Palnitkar, "Verilog HDL, A guide to Digital design and synthesis", 2nd Edition, Pearson Education, 2008.

Suggested Reading:

1. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill, 4th Edition, 2009.
2. Thomas L. Floyd, "Digital Fundamentals", Pearson, 11th Edition, 2015.

20EGM03

UNIVERSAL HUMAN VALUES II: UNDERSTANDING HARMONY

(Common for all Programs)

Instruction	2 L+1T Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	3

Prerequisite: Knowledge of UNIVERSAL HUMAN VALUES I

Course Objectives:

This course aims to:

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society, and nature/existence.
2. Understanding (or developing clarity) of the harmony in human being, family, society, and nature/existence.
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Students are expected to become more aware of themselves, and their surroundings (family, society, nature)
2. They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
3. They would have better critical ability.
4. They would also become sensitive to their commitment towards what they have understood (human values, human relationship, and human society).
5. It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

The course has 28 lectures and 14 practice sessions:

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	-	-	1	-	-	1	-	-	1	-	-	1	-	-	-
CO 2	-	-	1	-	-	1	1	-	1	-	1	1	-	-	-
CO 3	--	-	-	-	-	1	-	-	-	1	-	-	-	-	-
CO 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	-	-	-	1	-	-	-	-	1	1	1	1	-	-	-

UNIT-I

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

- Purpose and motivation for the course, recapitulation from Universal Human Values-I
- Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation-as the process for self-exploration.
- Continuous Happiness and Prosperity- A look at basic Human Aspirations.

- Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority.
- Understanding Happiness and Prosperity correctly- A critical appraisal of the current Scenario.
- Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

UNIT-II

Understanding Harmony in the Human Being - Harmony in Myself

- Understanding human being as a co-existence of the sentient 'I' and the material 'Body'.
- Understanding the needs of Self ('I') and 'Body' - happiness and physical facility.
- Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer).
- Understanding the characteristics and activities of 'I' and harmony in 'I'.
- Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.
- Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.

UNIT-III

Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship

- Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship.
- Understanding the meaning of Trust; Difference between intention and competence.
- Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship.
- Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co -existence as comprehensive Human Goals.
- Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

UNIT-IV

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

- Understanding the harmony in the Nature.
- Interconnectedness and mutual fulfilment among the four orders of nature - recyclability and self-regulation in nature.
- Understanding Existence as Co-existence of mutually interacting units in all - pervasive space.
- Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

UNIT-V

Implications of the above Holistic Understanding of Harmony on Professional Ethics

- Natural acceptance of human values.
- Definitiveness of Ethical Human Conduct.
- Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order.
- Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
- Case studies of typical holistic technologies, management models and production systems.
- Strategy for transition from the present state to Universal Human Order:

a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers.
b. At the level of society: as mutually enriching institutions and organizations.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.

Mode of Conduct (L-T-P-C 2-1-0-3)

- Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them. Tutorial hours are to be used for practice sessions.
- While analysing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.
- In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self- exploration.
- Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.
- Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practicals are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignments and/or activities are included.
- The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

Assessment:

This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self- assessment, peer assessment etc. will be used in evaluation.
Example:
Assessment by faculty mentor: 10 marks
Self-assessment/Assessment by peers: 10 M
Socially relevant project/Group Activities/Assignments: 20 marks
Semester End Examination: 60 marks
The overall pass percentage is 40%. In case the student fails, he/she must repeat the course.

Text Books:

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1 The teacher's manual
2. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books:

1. A Nagaraj Jeevan Vidya: Ek Parichaya, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.
3. Cecile Andrews, Slow is Beautiful
4. Gandhi - Romain Rolland (English)
5. Dharampal, "Rediscovering India"
6. E. FSchumacher. "Small is Beautiful."
7. J. C. Kumarappa "Economy of Permanence"
8. Pandit Sunderlal "Bharat Mein Angreji Raj"
9. Mohandas Karamchand Gandhi "The Story of My Experiments with Truth"
10. 10.Mohandas K. Gandhi, "Hind Swaraj or Indian Home Rule"
11. Maulana Abdul Kalam Azad, India Wins Freedom -
12. Vivekananda - Romain Rolland (English)
13. The Story of Stuff (Book).

20EGM01

INDIAN CONSTITUTION AND FUNDAMENTAL PRINCIPLES

(Common to all Programs)

Instruction	2 L Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	0 Marks
Credits	No Credits

Prerequisite: Knowledge of social studies.

Course Objectives:
This course aims to:

1. History of Indian Constitution and how it reflects the social, political, and economic perspectives of the Indian society.
2. Growth of Indian opinion regarding modern Indian intellectuals constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. Various Organs of Governance and Local Administration.

Course Outcomes:
Upon completion of this course, students will be able to:

1. Understand the making of the Indian Constitution and its features.
2. Identify the difference among Right To equality, Right To freedom and Right to Liberty.
3. Analyze the structuring of the Indian Union and differentiate the powers between Union and States.
4. Distinguish between the functioning of Lok Sabha and Rajya Sabha while appreciating the importance of Judiciary.
5. Differentiate between the functions underlying Municipalities, Panchayats and Co-operative Societies.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/ PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	-	-	-	-	-	-	-	-	-	-	-		-	-	-
CO 2	--	-	-	-	-	1	-	-	-	-	-	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-

UNIT-I
Constitution of India: Constitutional history-Govt of India Act 1909, 1919 and 1935, Constitution making and salient features. Directive Principles of State Policy - Its importance and implementation.

UNIT-II
Scheme of the Fundamental Rights & Duties: The Fundamental Rights - To Equality, to certain Freedom under Article 19, to Life and Personal Liberty Under Article 21. Fundamental Duties - the legal status.

UNIT-III
Union Government and its Administration - Structure of the Indian Union: Federalism, distribution of legislative and financial powers between the Union and the States. Parliamentary form of government in India: Executive-President's role, power and position.

UNIT-IV

Legislature and Judiciary: Central Legislature-Powers and Functions of Lok Sabha and Rajya Sabha.
Judiciary: Supreme Court-Functions, Judicial Review and Judicial Activism.

UNIT-V

Local Self Government - District's Administration Head (Collector): Role and Importance.
Municipalities: Introduction, Mayor and Role of Elected Representative, CEO of Municipal Corporation.
Panchayati Raj: Introduction, Zilla Panchayat, Elected Officials and their roles, CEO Zilla Panchayat: Position and Role. Block level: Organizational Hierarchy (Different departments). Village level: Role of Elected and Officials.

Text Books:

1. Indian Government & Politics, Ed Prof V Ravindra Sastry, Telugu Akademy, 2nd Edition, 2018.
2. Indian Constitution at Work, NCERT, First Edition 2006, Reprinted- January 2020.

Suggested Reading:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, Framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edition., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Online Resources:

1. http://www.nptel.ac.in/courses/103107084/Script.pdf

20EGM02

INDIAN TRADITIONAL KNOWLEDGE

(Common to all Programs)

Instruction	2 L Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	0 Marks
Credits	No Credits

Prerequisite: Knowledge on Indian Culture.

Course Objectives:
This course aims to:
1. To get a knowledge in Indian Culture
2. To know Indian Languages and Literature and the fine arts in India
3. To explore the Science and Scientists of Medieval and Modern India.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Understand philosophy of Indian culture.
2. Distinguish the Indian languages and literature.
3. Learn the philosophy of ancient, medieval, and modern India.
4. Acquire the information about the fine arts in India.
5. Know the contribution of scientists of different eras.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/ PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	--	-	1	-	-	1	-	-	-	-	-	-	-	-	-
CO 2	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	-	-	-	1	-	-	-	-	-	-	-	1	-	-	-

UNIT-I
Culture and Civilization: Culture, civilization and heritage, general characteristics of culture, importance of culture in human literature, Cultural diversity, Aesthetics, Women seers, Indus culture, Indian cuisine, Martial arts.

UNIT-II
Education system: Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India.

UNIT-III
Linguistic Wealth: Indian Languages and Literature: the role of Sanskrit, Paleography, Significance of scriptures to current society, Indian semantics and lexicography, Bhakti literature, Darsanas.

UNIT-IV

Science and Logic: Helio-centic system, Sulbasutras, Katapayadi, Hindu calendar, 6 pramanas in Indian logic, Scientific method applied to therapeutics, Fallacies, Tarka – Induction &Deduction, Ayurvedic biology, Definition of health.

UNIT-V

Behavioral Modeling: Structured Procedures, Procedural Assignments, Timing control, Conditional statements, Sequential and Parallel Blocks. Switch level Modelling. Introduction to tasks and functions. Design of Mealy and Moore state models using Verilog HDL. Introduction to Logic Synthesis. Concept of Programming using FPGA.

Text Books:

1. Kapil Kapoor, Text and Interpretation: The Indian Tradition, ISBN: 81246033375, 2005.
2. Samskrita Bharati, Science in Samskrit, ISBN-13: 978-8187276333, 2007.
3. Satya Prakash, Founders of sciences in Ancient India, Govindram Hasanand, ISBN-10: 8170770009, 1989.
4. Brajendranath Seal, The Positive Sciences of the Ancient Hindus, Motilal Banarasidass, ISBN-10: 8120809254, 1915.

Suggested Reading:

1. Swami Vivekananda, *Caste, Culture and Socialism*, Advaita Ashrama, Kolkata ISBN-9788175050280.
2. Swami Lokeswarananda, *Religion and Culture*, Advaita Ashrama, Kolkata ISBN-9788185843384.
3. Kapil Kapoor, *Language, Linguistics and Literature: The Indian Perspective*, ISBN-10: 8171880649, 1994.
4. Karan Singh, *A Treasury of Indian Wisdom: An Anthology of Spiritual Learn*, ISBN: 978-0143426158, 2016.
5. Swami Vivekananda, *The East and the West*, Advaita Ashrama, Kolkata 9788185301860.
6. Srivastava R.N., *Studies in Languages and Linguistics*, Kalinga Publications ISBN-13: 978-8185163475.
7. Subhash Kak and T.R.N. Rao, Computation in Ancient India, Mount Meru Publishing ISBN-1988207126.
8. R.N Misra, *Outlines of Indian Arts Architecture, Painting, Sculpture, Dance and Drama,* IIAS, Shimla & Aryan Books International, ISBN 8173055149.
9. S. Narain, *Examinations in ancient India*, Arya Book Depot, 1993.
10. M. Hiriyanna, Essentials of Indian Philosophy, Motilal Banarsidass Publishers, ISBN-13: 978-8120810990, 2014.
11. Ravi Prakash Arya, Engineering and Technology in Ancient India, Indian Foundation for Vedic Science, ISBN-10: 1947593072020.

SWAYAM / NPTEL:

1. History of Indian Science and Technology - https://onlinecourses.swayam2.ac.in/arp20_ap35/preview
2. Introduction to Ancient Indian Technology – https://onlinecourses.nptel.ac.in/noc19_ae07/preview
3. Indian Culture & Heritage - https://onlinecourses.swayam2.ac.in/nos21_sc11/preview
4. Language and Society - https://nptel.ac.in/courses/109/106/109106091/
5. Science, Technology & Society - https://nptel.ac.in/courses/109/103/109103024/
6. Introduction to Indian Philosophy - https://nptel.ac.in/courses/109/106/109106059/
7. Introduction to Indian Art - An appreciation - https://onlinecourses.nptel.ac.in/noc20_hs09/preview

20ECC12

ANALOG CIRCUTS LAB

Instruction	2 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Prerequisite: Knowledge on Electronic Devices Lab and Electronic Workshop and Networks Lab.

Course objectives:
This course aims to:
1. Design and analysis of Biasing circuits and Power Amplifiers.
2. Know frequency response and behaviour of various Single Stage, Multistage and Feedback amplifiers.
3. Generation of sinusoidal signals using Oscillators.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Design various BJT/FET biasing circuits to identify the appropriate circuit for faithful amplification.
2. Experiment with single stage and multistage BJT/FET amplifiers including large signal amplifiers.
3. Compare and contrast different types of feedback topologies.
4. Develop and test various oscillator circuits.
5. Evaluate and compare the significant parameters obtained from the Frequency response plots of BJT and FET amplifier circuits.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	1	3	2	2	-	-	-	2	1	-	1	3	2	-
CO 2	2	1	3	2	2	-	-	-	2	1	-	1	3	2	-
CO 3	2	1	3	2	2	-	-	-	2	1	-	1	3	2	-
CO 4	2	1	3	2	2	-	-	-	2	1	-	1	3	2	-
CO 5	2	1	3	2	2	-	-	-	2	1	-	1	3	2	-

List of Experiments:

1. Design of BJT and FET Biasing Circuits for given specifications.
2. Design of a Common Emitter BJT amplifier and study of its frequency response.
3. Frequency response of Two RC - Coupled CS FET amplifier
4. Voltage series feedback amplifier.
5. Voltage shunt feedback amplifier.
6. Current series feedback amplifier.
7. Current shunt feedback amplifier.
8. RC Phase Shift Oscillator.
9. Hartley Oscillator
10. Colpitts Oscillator.
11. Design of transformer coupled Class-A amplifier.

12. Design of Class-B power amplifier.
13. **Structured enquiry:** Design a circuit that converts a given D.C Voltage to Frequency using BJTs and verify its operation.
14. **Open ended Enquiry:** Design and implement a classroom sound monitoring system using BJTs and a 0.5W speaker.

Note: Wherever possible, Analysis and design of circuits should be carried out using SPICE tools.

Suggested Reading:

1. Robert Diffenderfer, "Electronic Devices: Systems and Applications", Cengage Learning India Private Limited, 2010.
2. Paul B. Zbar, Albert P. Malvino, Michael A. Miller, "Basic Electronics, A Text - Lab Manual", 7th Edition, TMH 2001.

20ECC13

ANALOG COMMUNICATION LAB

Instruction	2 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Prerequisite: A thorough knowledge on signal analysis and its representation along with communication systems is required.

Course Objectives:
This course aims to:
1. Generate and detect various analog and pulse modulation schemes.
2. Develop and analyze the characteristics of PLL, Mixer and Pre-Emphasis & De-Emphasis circuits.
3. Estimate the power spectral density by analyzing the spectrum of a given signal.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Demonstrate the generation and detection of various analog modulated signals.
2. Illustrate the sampling concept and interpret the generation and detection of various pulse modulated signals.
3. Obtain and Analyze frequency response of Pre-Emphasis and De Emphasis circuits
4. Experiment with Mixer, Radio receiver and PLL characteristics, FDM and TDM.
5. Estimate the Power spectral density of noise and SNR and analyze the spectra of AM and FM signals.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	1	1	2	2	3	3	3	3	3	3	3	3
CO 2	3	3	3	1	1	2	2	3	3	3	3	3	3	3	3
CO 3	3	3	3	1	1	2	2	3	3	3	3	3	3	3	3
CO 4	3	3	3	2	1	2	2	3	3	3	3	3	3	3	3
CO 5	3	3	3	3	1	2	2	3	3	3	3	3	3	3	3

List of Experiments:

1. AM signals generation and detection.
2. Generation of DSB-SC using Balanced modulator.
3. SSB Modulation and Demodulation.
4. FM generation and detection.
5. Frequency response of Pre-Emphasis and De-Emphasis circuits.
6. Evaluation of Radio Receiver characteristics.
7. Sampling of continuous time signal and its Reconstruction (PAM).
8. Frequency division multiplexing and De-Multiplexing.
9. Time division multiplexing and De-Multiplexing.
10. PWM Modulation and Demodulation.
11. PPM Modulation and Demodulation.
12. Determination of PLL Characteristics.
13. Spectral Analysis of AM and FM signals using Spectral Analyzer.

14. **Structured Enquiry:** Design a frequency mixer based on the given specifications and analyze its characteristics.
15. **Open ended Enquiry:** Design a Phase Locked Loop for the given free running frequency and determine its capture range and Lock range.

Note: Students have to design and develop any concept as a part of Mini project**.**

Suggested Reading:

1. A.M. Zungeru, J.M. Chuma, M. Mangwala, L.K. Ketshabetswe, "Handbook of Laboratory Experiments in Electronics and Communication Engineering", Vol. 2, 1st Edition, Notion press, 2017.

20ECC14

DIGITAL SYSTEM DESIGN LAB

Instruction	2 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Prerequisite: Digital concepts and C language concepts.

Course Objectives:
This course aims to:
1. Simulate and synthesize combinational logic circuits.
2. Simulate and synthesize sequential logic circuits.
3. Learn and implement procedure for any digital design.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Design a Digital circuit using Verilog HDL.
2. Understand various abstraction levels of a digital design.
3. Verify the functionality of a design using Test bench.
4. Simulate and synthesize combinational logic circuits.
5. Simulate and synthesize sequential logic circuits.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	2	3	1	1	1	3	2	1	1	2	3	3
CO 2	3	2	2	2	3	1	1	1	3	2	1	1	2	3	3
CO 3	3	3	2	2	3	2	2	1	3	2	2	2	2	3	3
CO 4	3	3	2	3	3	2	2	2	3	2	2	2	3	3	3
CO 5	3	3	2	3	3	2	2	2	3	2	2	2	3	3	3

List of Experiments:

Write a Verilog HDL code to Simulate and synthesize the following in Gate level, Data flow and Behavioral Modeling styles.

1. Logic Gates.
2. Arithmetic Units: Adders and Subtractors.
3. Multiplexers and De-multiplexers.
4. Encoders, Decoders, Priority Encoder and Comparator.
5. Implementation of logic function using Multiplexers and Decoders.
6. Arithmetic and Logic Unit.
7. Flip-Flops.
8. Sequence Detector using Mealy and Moore type state machines.
9. Implementation of SSI Circuits using FPGA.
10. **Structured Enquiry:** Design of a counter for the given specifications.
11. **Open ended Enquiry:** Design of a simple Digital System for real time applications.

Suggested Reading:

1. Samir Palnitkar, "Verilog HDL, A guide to Digital design and synthesis", 2nd Edition, Pearson Education, 2008.